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Registration number
Numéro d'accréditation : **STS 024**
Akkreditierungsnummer



Schweizerischer Prüfstellendienst
Service suisse d'essai
Swiss testing service

Report no:
Rapport no: **13'677A**
Bericht Nr:

Title: **Type acceptance measurements for a 216-217 MHz transmitter « SmartLink SX » according to the Code of federal regulations 47 : Parts 2 (General rules and regulations) and 95 (LPRS transmitters)**
Titre:
Titel:

Date of test:
Date de l'essai: **February 4th – 20th, 2004 and October 2005**
Prüfdatum:

Customer:
Client: **Phonak Communications AG**
Kunde:

Test place: **montena emc sa**
Lieu de l'essai: **CH-1728 Rossens**
Prüfort: **Switzerland**

Test performed by
Essai effectué par :
Prüfer

Mr Manfred Portmann
Mr Erich Staub

Test report prepared by
Rapport d'essai préparé par :
Berichterstatter

Mr Manfred Portmann
Mr Erich Staub

Test report controlled and approved by
Rapport d'essai contrôlé et approuvé par :
Prüfbescheinigung

Mr Emmanuel de Raemy

Rossens, November 4, 2005 (Issue Date / Date d'édition / Ausstelldatum)

V0111

Main language / Langue principale / Hauptsprache: english / français / deutsch

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Contents / Table des matières / Inhaltsverzeichnis

	<i>Page/Page/Seite</i>
1. Summary of test results / Résumé des résultats d'essais / Zusammenfassung der Prüfergebnisse	3
2. Client / Client / Kunde	4
3. Equipment under test / Equipement à l'essai / Prüfling	4
4. Test instrumentation and procedures	5
5. Test specification requirements	5
6. Test conditions / Conditions d'essai / Testbedingungen	5
7. Persons present / Personnes présentes / Anwesende Personen	5
8. Emission Tests / Essais d'émission / Störaussendungsmessungen	6
8.1. Designation of emission / Désignation d'émission / Bezeichnung der Emission	6
8.2. RF power output / Puissance RF / HF Leistung	7
8.3. Modulation characteristics / Caractéristiques de modulation / Modulationscharakteristiken	9
8.4. Occupied bandwidth / Bande passante / Bandbreite	10
8.5. Unwanted radiation / Champ rayonné / Störfeldstärke	18
8.6. Frequency stability / Stabilité de fréquence / Frequenzstabilität	20

Total number of pages

Nombre total de pages du rapport: 20

Total Anzahl Seiten

1. Summary of test results / Résumé des résultats d'essais / Zusammenfassung der Prüfergebnisse

- ✓ Pass / Réussi / Bestanden
 X Fail / Pas réussi / Nicht bestanden
 □ Not applicable to this type of product / Pas applicable à ce type de produit / Nicht anwendbar für diese Produktart
 — No test / Pas d'essai / Nicht geprüft

Test Type / Type d'essai / Art der Prüfung	References/ Références / Referenzen	Result / Résultat / Ergebnis
Designation of emission Désignation d'émission Bezeichnung der Emission	FCC 47 §2.201 FCC 47 §2.202	✓
RF power output Puissance RF HF Leistung	FCC 47 §2.1046 FCC 47 §95.639 (e)	✓
Modulation characteristics Caractéristiques de la modulation Modulationscharakteristiken	FCC 47 §2.1047	✓
Occupied bandwidth Bande passante Bandbreite	FCC 47 §2.1049 FCC 47 §95.635 (c)(1)	✓
Field strength of spurious radiation Champ émis Feldstärke der Nebenaussendung	FCC 47 §2.1053 FCC 47 §95.635 (c)(1)	✓
Frequency stability Stabilité de fréquence Frequenzstabilität	FCC 47 §2.1055 FCC 47 §95.629 (d)(2)	✓

United States: 47 CFR "Code of Federal Regulations" - Telecommunication
FCC Part 2: Frequency allocations and radio treaty matters; General rules and regulations
FCC Part 95: Low power radio service (LPRS)

2. Client / Client / Kunde

Client name and address Nom et adresse du client Name und Adresse des Kunden	<i>Phonak Communications AG Länggasse 17 CH-3280 Murten Switzerland</i>
Contact Person / Responsable / Kontaktperson	<i>Mr François Marquis</i>
Telephone / Téléphone / Telefon	<i>+41 (0)26 672 96 74</i>
Fax / Télécopieur / Telefax	<i>+41 (0)26 672 96 77</i>
Mandate no / Mandat no / Auftrag Nr.	<i>2004-6016</i>

3. Equipment under test / Equipement à l'essai / Prüfling

Manufacturer name and address Nom et adresse du fabricant Name und Adresse des Herstellers	<i>Phonak Communications AG Länggasse 17 CH-3280 Murten Switzerland</i>
Product name / Nom du produit / Produktname	<i>SmartLink SX</i>
Product description / Description du produit / Produktbeschreibung	<i>One channel FM-transmitter for use as an auditory assistance device in the low power radio service (LPRS) band. The device contains an integral antenna and one external "Lavalier cord"</i>
Production country / Pays de fabrication / Ursprungsland	<i>Switzerland</i>
Product type / Type du produit / Typ des Produktes	<i>SmartLink SX</i>
Serial no / No. de série / Seriennummer	<i>Proto FCA-1</i>
Highest frequency / Frequence plus élevée / Höchste Frequenz	<i>217 MHz</i>
Modifications before the tests Modifications apportées avant les essais Vor den Prüfungen angebrachte Änderungen	<i>None</i>

4. Test instrumentation and procedures

The list of the test equipment (stocklist number) is provided for each test given in the appendices. The equipment is calibrated at defined intervals with traceability.

The test procedures used are in accordance with ANSI C63.4 "Method of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz".

5. Test specification requirements

The EUT must comply with the requirements of 47 CFR "Code of Federal Regulations" - Telecommunication, FCC Part 2 and Part 95.

6. Test conditions / Conditions d'essai / Testbedingungen

Temperature / Température / Temperatur:

22 °C

Pressure / Pression / Druck:

1005 hPa

Relative humidity / Humidité relative / Relative Luftfeuchtigkeit:

38 %

Test period / Date des essais / Datum der Prüfungen:

February 4th – 20th, 2004
and October 2005

7. Persons present / Personnes présentes / Anwesende Personen

Test Engineer(s) / Ingénieur(s) d'essai / Prüfsingenieur(e) :

Mr Manfred Portmann

Mr Erich Staub

Other(s) / Autre(s) / Andere :

Name / Nom / Name

Company / Société / Firma

Mr François Marquis

Phonak Communications AG

Mr Reto Philp (partly)

Phonak Communications AG

8.2. RF power output / Puissance RF / HF Leistung

Standard: United States: 47 CFR "Code of Federal Regulations" - Telecommunication

☒ FCC Part 2, Subpart J: Certification: §2.1046☒ FCC Part 95, Subpart E: Technical regulations: §95.639(e)

Limit for LPRS = 100 mW = 20 dBm

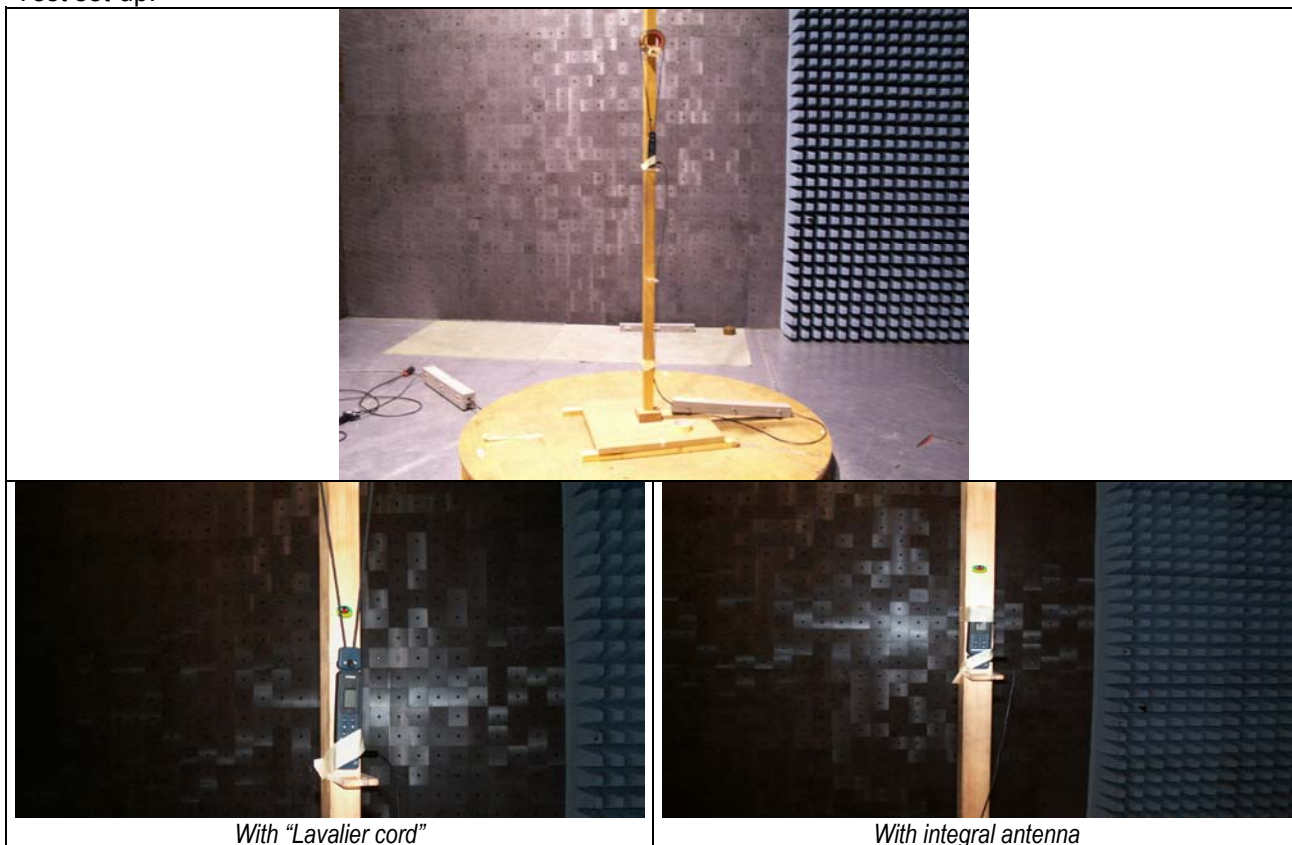
Test site: ☐ anechoic chamber (foam) ☐ open test site☒ anechoic chamber (ferrites) ☐Distance: ☐ 30 m ☐ 10 m ☒ 3 m ☐

Position of EUT: 1.5 m (height of the equipment under test above floor)

Test precision: ± 6 dB (30 - 300 MHz) / ± 5.4 dB (300 - 1000 MHz)

Test method: According to ANSI TIA-603-C-2004

Test set-up:



Test equipment:

Spectrum analyser	☒ 88-14	☐ 90-26	☐ 94-24	☐ 02-06	☐ 03-45	☐ 03-57
Preamplifier	☐ 88-05	☐ 90-01	☐ 90-42	☐ 97-08	☒ 05-87	
Antenna (biconical)	☐ 82-02	☐ 87-05	☐ 87-16	☐ 91-05	☒ 05-00	
Antenna (dipole)	☒ 89-01					
Antenna (bilog)	☒ 94-03	☐ 05-38				
Antenna (horn)	☐ 90-24	☐ 90-29	☐ 98-12	☐ 98-13	☐	

Result: ☒ pass ☐ fail ☐ not applicable ☐ not tested



With Lavalier cord

f [MHz]	Polaris.		P ERP [dBm]
	Hor	Vert	
216.44	☐	☒	7.20
216.44	☒	☐	-10.00

With integral antenna

f [MHz]	Polaris.		P ERP [dBm]
	Hor	Vert	
216.44	☐	☒	-18.60
216.44	☒	☐	-29.30

Date of test: *October, 2005*
Operator: *Erich Staub*

8.3. Modulation characteristics / Caractéristiques de modulation / Modulationscharakteristiken

Standard: United States: 47 CFR "Code of Federal Regulations" - Telecommunication
☒ FCC Part 2, Subpart J: Certification: §2.1047

Test site: ☐ anechoic chamber (foam) ☐ open test site
☐ anechoic chamber (ferrite) ☒ laboratory

Frequency response of audio circuit: An audio signal at 1 kHz was adjusted for a 100 % rated FM deviation (= 30 mV rms). While maintaining the same amplitude, the frequency was varied. The FM deviation was measured and recorded at several frequencies in order to determine the frequency response.

Frequency [kHz]	Dev [kHz]
0.1	2.5
0.2	4.2
0.3	4
0.4	4.15
0.5	4.07
0.6	4.13
0.7	4.09

Frequency [kHz]	Dev [kHz]
0.8	4.09
0.9	4.15
1.0	4.1
1.2	4
1.5	4
2.0	3.9
2.5	3.75

Frequency [kHz]	Dev [kHz]
3.0	3.9
3.5	3.7
4.0	3.6
4.5	3.6
5.0	3.5
5.5	3.4
6.0	3.5

Frequency [kHz]	Dev [kHz]
6.5	2.6
7.0	0.7
7.5	0.07
8.0	0
8.5	0
9.0	0
9.5	0

Modulation limiting: An audio signal at 1 kHz was adjusted for a 100 % rated FM deviation (= 30 mV rms). While maintaining the same frequency, the audio level was varied. The FM deviation was measured and recorded at different audio levels in order to determine the modulation limiting.

Audio signal level [mV rms]	FM Déviation (1000 Hz)
1	1.43
2	2.82
3	4.1
4	4
5	4
10	4.1
20	4.2
50	4.3
100	4.4
200	4.1

Mic Input: The sensitivity of the audio input is 26 dB above the sensitivity of the microphone input; the adjustment is made with resistors.

The characteristics of the microphone is: 75 dBPSL $\Rightarrow$ 1 mVrms

Test equipment:

☒ Analyzer	☒ HP 8920B
☐	

Results: ☒ complies ☐ does not comply ☐ not applicable ☐ not done

**8.4. Occupied bandwidth / Bande passante / Bandbreite**

Standard: United States: 47 CFR "Code of Federal Regulations" - Telecommunication

☒ FCC Part 2, Subpart J: Certification: §2.1049☒ FCC Part 95, Subpart E: Technical regulations: §95.635(c)(1)Test site: ☐ anechoic chamber (foam) ☐ open test site
☐ anechoic chamber (ferrite) ☒ laboratoryTest precision: ± 4.6 dB

Test requirements: Emissions for transmitters operating on standard band channels (25 kHz) shall be attenuated below the unmodulated carrier in accordance with the following:

- Emissions 12.5 kHz to 22.5 kHz away from the channel center frequency:
at least 30 dB
- Emissions more than 22.5 kHz away from the channel center frequency:
at least $43 + 10 \log$ (carrier power in watts) dB

Test method: The audio signal input was set to 30 V rms (= FM deviation max). For different input frequencies the fundamental frequency was plotted.

Test equipment:

☒ Spectrum analyzer ☒ 88-14 ☐ 90-26 ☐ 94-24☐Results: ☒ complies ☐ does not comply ☐ not applicable ☐ not done



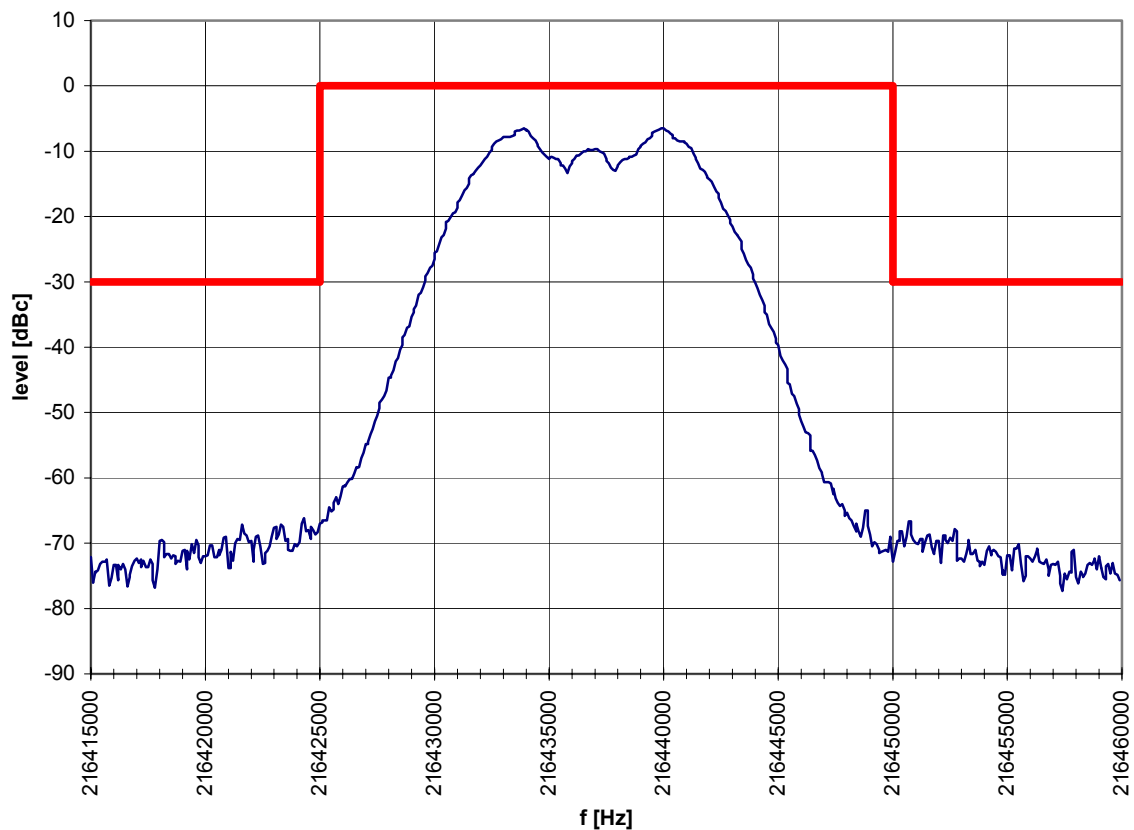
Measurement Type: Power interference

Equipment under test: SmartLink SX

Set-Up:

Operating conditions: Faudio= 1.0 kHz, Level = 100 mV

Remarks: Audio Input





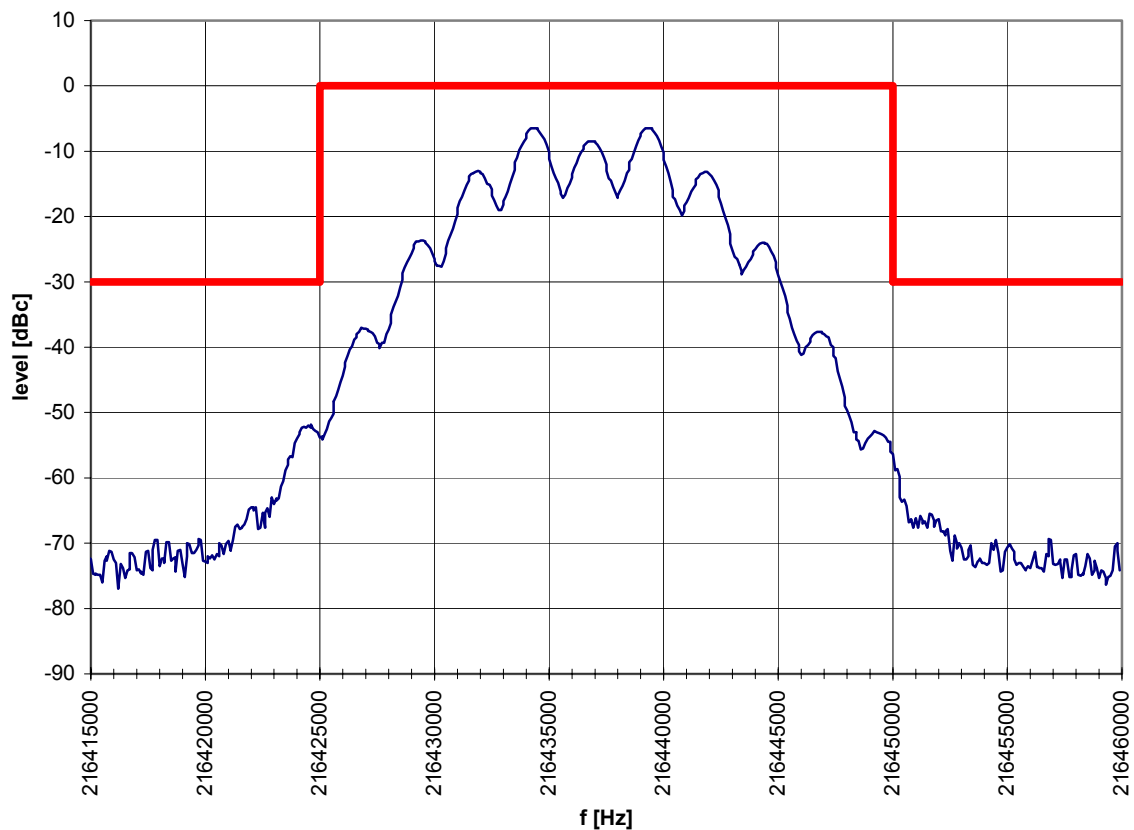
Measurement Type: Power interference

Equipment under test: SmartLink SX

Set-Up:

Operating conditions: Faudio= 2.5 kHz, Level = 100 mV

Remarks: Audio Input





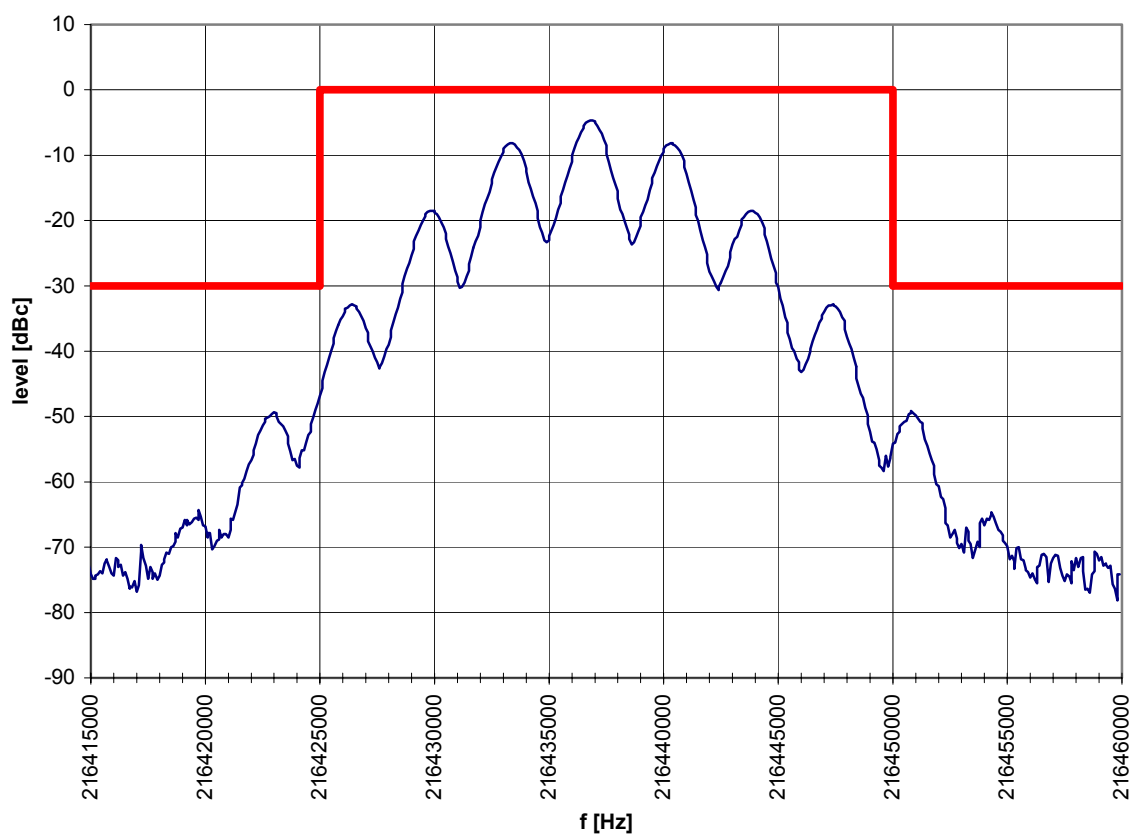
Measurement Type: Power interference

Equipment under test: SmartLink SX

Set-Up:

Operating conditions: Faudio= 3.5 kHz, Level = 100 mV

Remarks: Audio Input





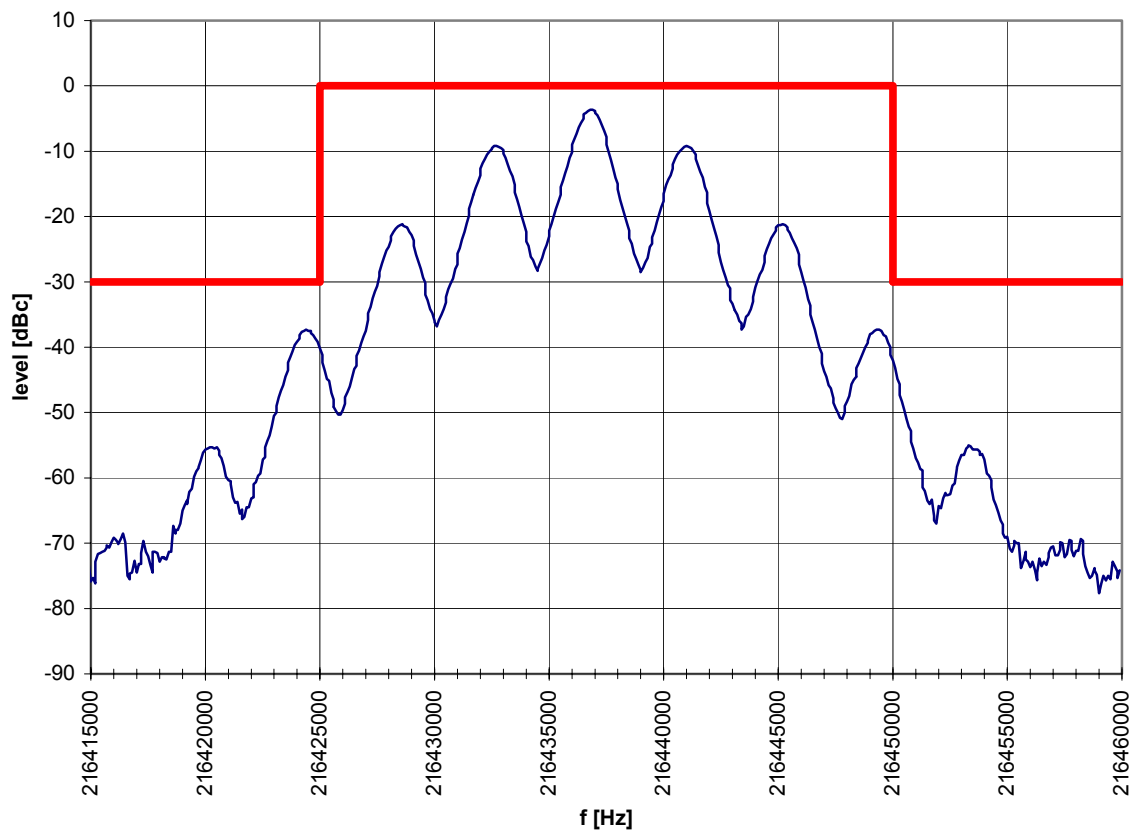
Measurement Type: Power interference

Equipment under test: SmartLink SX

Set-Up:

Operating conditions: Faudio= 4.16 kHz, Level = 100 mV

Remarks: Audio Input





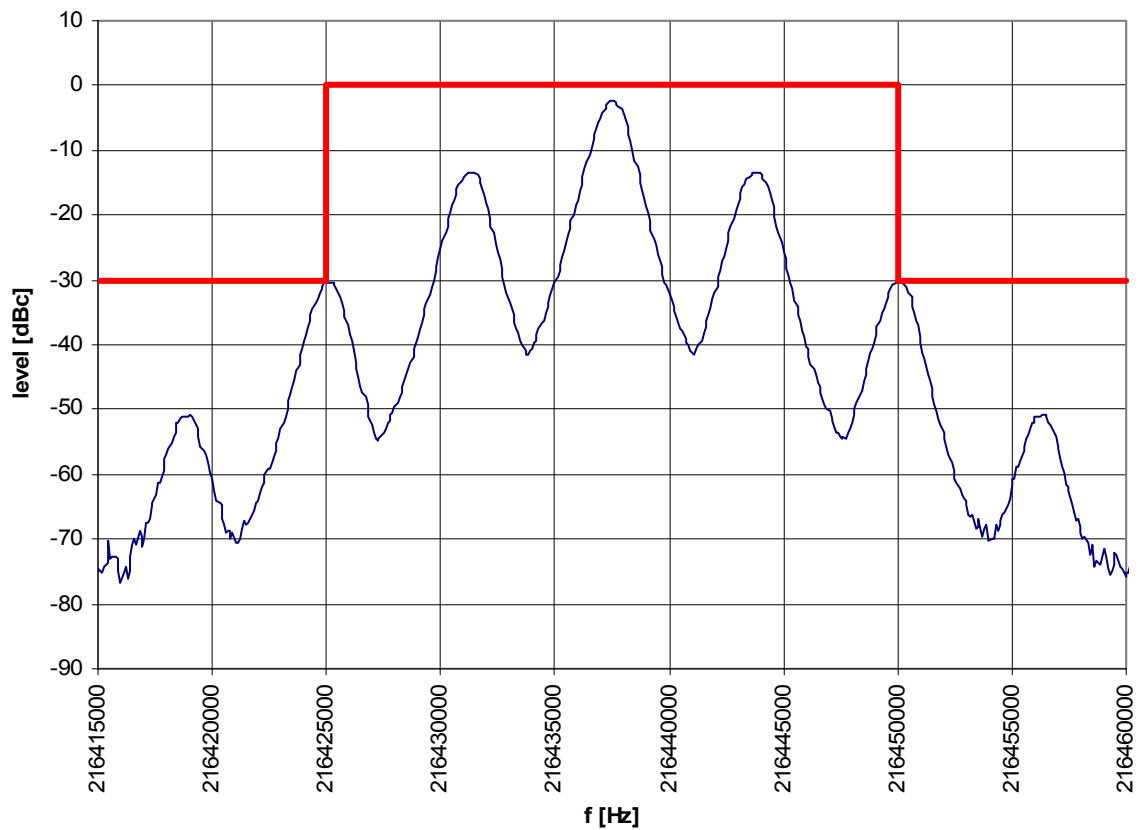
Measurement Type: Power interference

Equipment under test: SmartLink SX

Set-Up:

Operating conditions: Faudio= 6.25 kHz, Level = 100 mV

Remarks: Audio Input





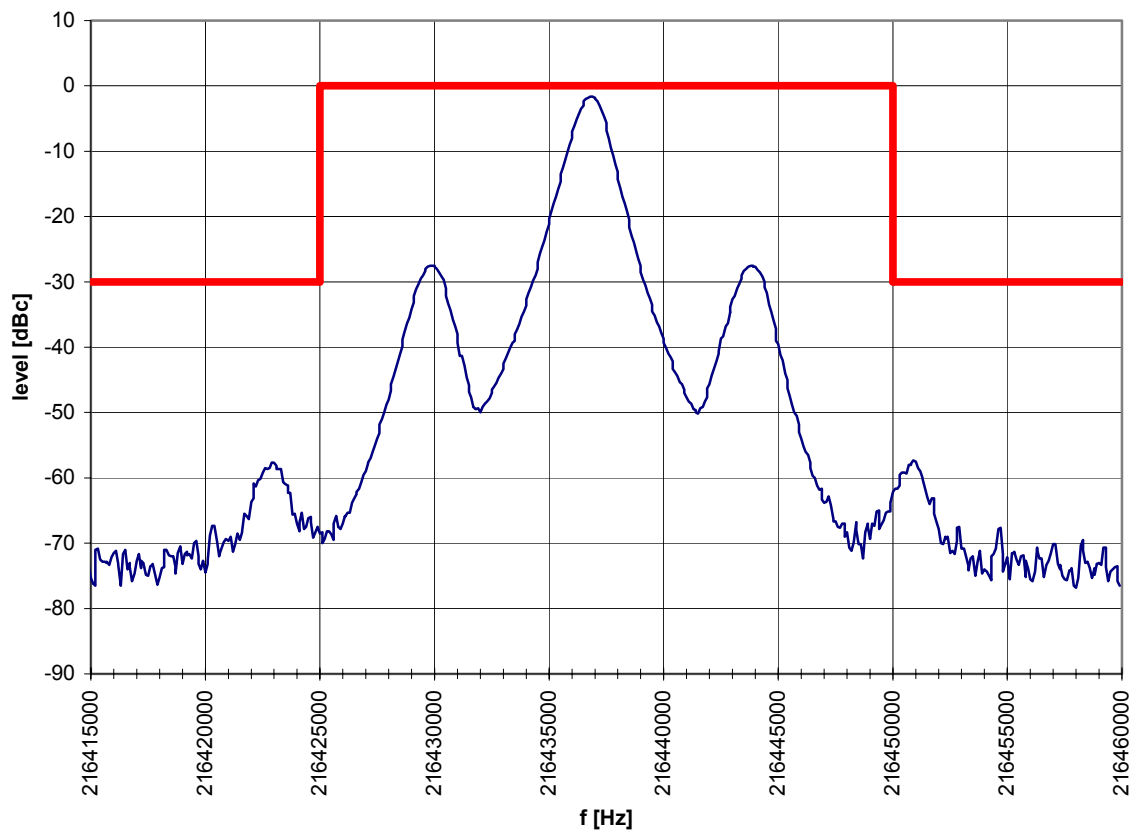
Measurement Type: Power interference

Equipment under test: SmartLink SX

Set-Up:

Operating conditions: Faudio= 7.0 kHz, Level = 100 mV

Remarks: Audio Input





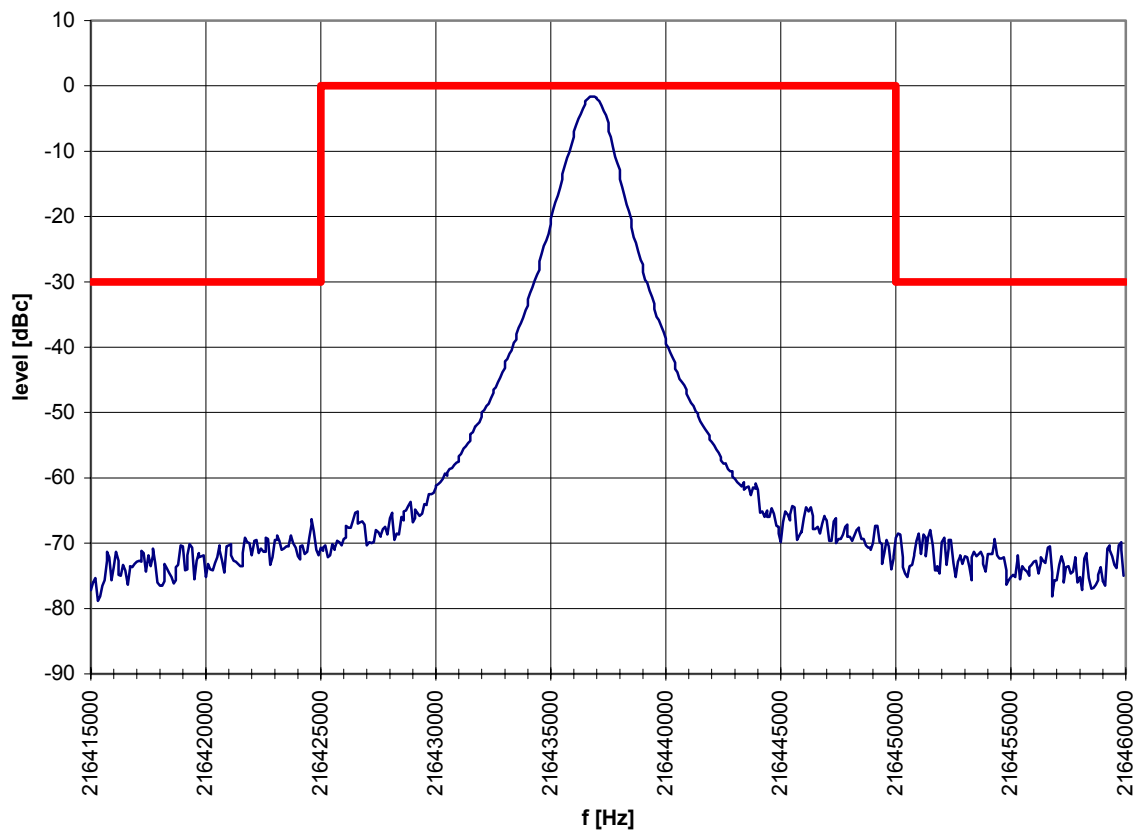
Measurement Type: Power interference

Equipment under test: SmartLink SX

Set-Up:

Operating conditions: Faudio= 8.0 kHz, Level = 100 mV

Remarks: Audio Input



**8.5. Unwanted radiation / Champ rayonné / Störfeldstärke**

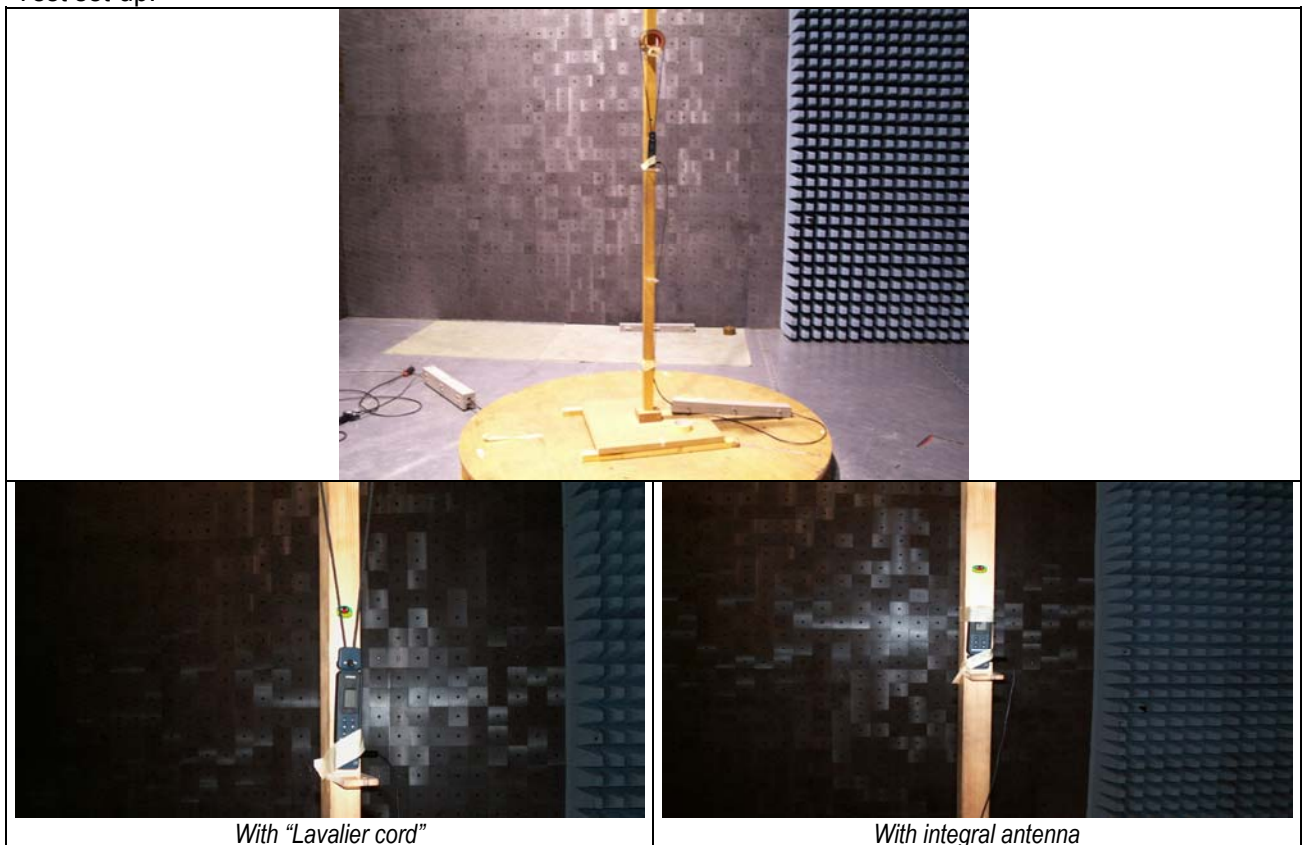
Standard: United States: 47 CFR "Code of Federal Regulations" - Telecommunication
☒ FCC Part 2, Subpart J: Certification: §2.1053
☒ FCC Part 2 §2.1047: Frequency range: up to tenth harmonic or 40 GHz
☒ FCC Part 95, Subpart E: Technical regulations: §95.635(c)(1)

Test site: ☐ anechoic chamber (foam) ☐ open test site
☒ anechoic chamber (ferrites) ☐
 Distance: ☐ 30 m ☐ 10 m ☒ 3 m ☐

Position of EUT: 1.5 m (height of the equipment under test above floor)

Test precision: ± 6 dB (30 - 300 MHz) / ± 5.4 dB (300 - 1000 MHz)

Test method: According to ANSI TIA-603-C-2004

Test set-up:**Test equipment:**

Spectrum analyser	☒ 88-14	☐ 90-26	☐ 94-24	☐ 02-06	☐ 03-45	☐ 03-57
Preamplifier	☐ 88-05	☐ 90-01	☐ 90-42	☐ 97-08	☒ 05-87	
Antenna (biconical)	☐ 82-02	☐ 87-05	☐ 87-16	☐ 91-05	☒ 05-00	
Antenna (dipole)	☒ 89-01					
Antenna (bilog)	☒ 94-03	☐ 05-38				
Antenna (horn)	☒ 90-24	☐ 90-29	☐ 98-12	☐ 98-13	☐	

Result: ☒ pass ☐ fail ☐ not applicable ☐ not tested

**With Lavalier cord**

f [MHz]	Polaris. Hor Vert		P ERP [dBm]	Limit -13 dBm
216.44	☐	☒	7.20	Carrier
432.88	☐	☒	-51.92	Pass
649.31	☐	☒	-45.50	Pass
1'082.19	☐	☒	-60.60	Pass
1'515.06	☐	☒	-59.07	Pass
216.44	☒	☐	-10.00	Carrier
432.88	☒	☐	-61.92	Pass
1'515.06	☒	☐	-59.90	Pass

With integral antenna

f [MHz]	Polaris. Hor Vert		P ERP [dBm]	Limit -13 dBm
216.44	☐	☒	-18.60	Carrier
1'082.19	☐	☒	-61.10	Pass
1'515.06	☐	☒	-59.40	Pass
216.44	☒	☐	-29.30	Carrier
1'515.06	☒	☐	-61.40	Pass

Date of test: *October, 2005*
 Operator: *Erich Staub*

**8.6. Frequency stability / Stabilité de fréquence / Frequenzstabilität**

Standard: United States: 47 CFR "Code of Federal Regulations" - Telecommunication
☒ FCC Part 2, Subpart J: Certification: §2.1055
☒ FCC Part 95, Subpart E: Technical regulations: §95.629(d)(2)

Test site: ☐ anechoic chamber (foam) ☐ open test site
☐ anechoic chamber (ferrite) ☒ laboratory

Test requirements and results: 1. Variation with the temperature
 requirement: $\Delta f < 50$ ppm with temperature varied from -30° to $+50^{\circ}$ in steps of 10 degrees.

Temperature	Frequency [MHz]	Difference ppm	Limit ppm
-30°C	216.436810	0.05	50
-20°C	216.436790	0.14	50
-10°C	216.436800	0.09	50
0°C	216.436790	0.14	50
10°C	216.436810	0.05	50
20°C	216.436820	reference	reference
30°C	216.436840	0.09	50
40°C	216.436880	0.28	50
50°C	216.436870	0.23	50

2. Variation with the supply voltage
 requirement: $\Delta f < 50$ ppm with supply voltage varied from 85% to 115%

Rated voltage	Frequency [MHz]	Change ppm	Limit ppm
85%	216.43682	0.00	50
Nominal	216.43682	reference	reference
115%	216.43681	0.05	50

Test equipment:

☒ FM - Analyzer	HP 8920B
☒ Spectrum analyzer	☐ 88-14 ☒ 90-26 ☐ 94-24
☐	

Results: ☒ complies ☐ does not comply ☐ not applicable ☐ not done